REMARKS/ARGUMENTS

In the Office Action dated October 28, 2003, Claims 1-19 are pending, of which Claims 1-11 have been elected for prosecution. Claims 1-4 and 6-11 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over "Neural Network-Based Control for the Fiber Placement Composite Manufacturing Process" (hereinafter "Lichtenwalner") and U.S. Patent No. 5,886,313 to Krause. Claims 4, 6, and 7 are also rejected under 35 U.S.C. § 103 (a) as being unpatentable over Lichtenwalner and Krause as applied to Claim 1 and further in view of U.S. Patent No. 5,562,788 to Kitson. Claim 10 is further rejected under 35 U.S.C. § 103 (a) as being unpatentable over Lichtenwalner and Krause as applied to Claim 1 and further in view of U.S. Patent No. 5,066,032 to Albers. Claim 5 is objected to as being dependent on a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim.

Applicant respectfully traverses each of the rejections. In particular, Applicant submits that none of the cited references teaches or describes a composite material collation machine having a laser diode array for heating at least one fiber tape. Further, as discussed below, none of the references provides a motivation for combining the laser diode array of the Krause device with the fiber placement process discussed by Lichtenwalner, and therefore the claimed invention is not made obvious by the cited references.

Lichtenwalner is directed to a neural network-based control for a fiber placement composite manufacturing process. Lichtenwalner describes fiber placement as

> a relatively new process that has evolved from two other automated composite fabrication processes: filament winding and tape laying. Similar to filament winding, fiber placement uses multiple tows of continuous composite material. . . . Combining the features of tape laying and filament winding yields a process that can produce shapes that are too complex for either filament winding or tape laying alone.

Page 687, Section 2. Thus, Lichtenwalner describes a fabrication process in which fibers are placed, not tapes. Indeed, Lichtenwalner specifically states that tape laying cannot produce complex shapes that can be produced with fiber placement. *See* Page 688, Section 2. Also,

while Lichtenwalner describes the use of a laser heat source, Lichtenwalner does not teach or suggest the use of a laser diode array.

The Examiner has recognized that Lichtenwalner does not disclose a laser diode array, but he asserts that it would have been obvious to a person of ordinary skill in the art to use a laser diode as disclosed by Krause in the Lichtenwalner process. Applicant respectfully disagrees and submits that no motivation existed for such a combination. Krause describes a laser diode array as an alternative to conventional laser bonding devices that require technical measures for distributing the laser light uniformly over a wide joint. Krause is directed to the bonding of metal layers in which such "bonding of metal layers must be performed without local melting of the surfaces of the two material surfaces to be joined. This imposes extreme demands on the homogeneity of the power density distribution at the joint." Col. 2, lines 29 to 33. Krause explains that "[i]n $CO_2$ lasers, homogenization is produced by beam-forming optics and/or vibrating mirrors. . . . If metal plates more than 1 meter wide are to be joined by bonding, a considerable technical and equipment cost is also required that entails correspondingly high costs to achieve homogenization of the power density distribution at the joining point of the two surfaces." Col. 2, lines 33 to 42.

Lichtenwalner, on the other hand, does not describe any requirement for such uniformity in the distribution of laser light. In fact, while Krause states that metal layers must be bonded without local melting, Lichtenwalner specifically identifies the heated composite material as defining a "melt region" and a "polymer melt pool." *See* Fig. 1. While the temperature of the composite material may be important for placement according to the process described by Lichtenwalner, there is no teaching of any particular requirement for uniformity in energy distribution or heating, only that an appropriate temperature is achieved at the nip point. Lichtenwalner does not describe any particular temperature threshold to which the fiber or polymer materials are sensitive and which would require careful uniformity in energy distribution. Thus, Lichtenwalner does not describe the requirement for the local control of temperature in composite manufacturing that required uniform distribution of light in the metal bonding of Krause.

Further, Lichtenwalner does not describe the heating of wide joints, as described by Krause, or any other requirement for the wide distribution of light. In fact, while Krause describes wide metal joints, e.g., joints having a width of 1 meter, Lichtenwalner is directed to the placement of composite fibers, which are typically narrow. Indeed, Lichtenwalner distinguishes the fibers even from composite tapes, stating that fiber placement can produce shapes that are too complex for tape laying. Presumably, such complex shapes can be produced, at least in part, for the very reason that the fibers are narrow, i.e., narrower than conventional composite tapes.

Thus, Applicant submits that no motivation exists for the combination of Krause and Lichtenwalner. The Examiner has asserted that Krause discloses motivations of long lifetime, low maintenance costs, and improved heating efficiencies. Applicant submits that while such advantages may apply to the use of a laser diode array in place of a laser used in the conventional metal bonding systems described by Krause, such advantages do not necessarily apply to the use of laser diode array in the process described by Lichtenwalner. Indeed, some or all of these advantages are likely derived as a result of the requirement for uniformity and distribution of laser light in conventional metal bonding systems, as described above. Lichtenwalner does not describe such requirements, as set forth above, and therefore it is unclear whether any of the advantages that the Examiner suggests could even apply to a laser diode array employed in a process such as that of Lichtenwalner. Further, neither Lichtenwalner nor Krause address whether a laser diode array would meet the technical requirements of the process described by Lichtenwalner.

For the foregoing reasons, Applicant suggests that Claim 1 is patentable over Lichtenwalner and Krause. The dependent claims 2-3, 6-9, and 11, which were also rejected as unpatentable over Lichtenwalner and Krause, provide additional bases of patentability over those references. For example, Claim 2 recites that "the laser diode array is configured to irradiate a plurality of irradiation zones such that each zone can be irradiated independently of the other irradiation zones." Claim 3, which is dependent on Claim 2, recites that "at least one of the irradiation zones defines an area on the fiber tape and at least one of the irradiation zones defines an area on the workpiece." The Examiner has asserted that the device of Krause is capable of

irradiating a plurality of irradiation zones and Lichtenwalner discloses that "some of the focused laser energy should be aimed at the area on the fiber tape and some of the focused laser energy should be aimed at the workpiece." However, Applicant submits that neither reference teaches or suggests a laser diode array configured to irradiate a zone on the fiber tape independently from a zone on the workpiece, as claimed.

Claim 4 recites that the inspection system includes "a camera for receiving images of the fiber tape after the fiber tape has passed through the compaction region." The Examiner has asserted that Lichtenwalner "discloses a focused infrared camera [that] monitors an image of the fiber tape at the point of bonding, i.e., past the compaction region (see page 687 and 688, especially section 2)." Applicant finds no teaching of an infrared camera for receiving images of the fiber tape as claimed. Lichtenwalner states that the neural network temperature control system includes an infrared temperature sensor, but there is no indication that the infrared temperature sensor is a camera that receives images of the fiber tape. In fact, there is no indication that the infrared temperature sensor monitors a temperature of more than one point. In any case, Applicant finds no teaching in Lichtenwalner that suggests that the infrared temperature sensor monitors a point past the compaction region. In fact, Lichtenwalner cites the importance of the temperature at the nip point. Indeed, in his comments regarding Claim 9, the Examiner states that "Lichtenwalner discloses a temperature sensor and controlling the laser heat source based on the temperature sensed at the nip point, i.e., at both the fiber tape and workpiece." Applicant cannot find any explicit statement regarding where the sensor senses, and Applicant submits that Lichtenwalner does not provide any motivation for sensing the temperature beyond the compaction region.

With regard to the rejections based on Lichtenwalner and Krause in view Kitson and Albers, Applicant submits that neither Kitson nor Albers describes a composite material collation machine with a laser diode array for heating at least one fiber tape, as set forth in Claim 1. Further, neither Kitson nor Albers provides any motivation for combining the laser diode array of the Krause device with the fiber placement process discussed by Lichtenwalner. Therefore, the invention of Claim 1 is patentable for the reasons set forth above, and each of the dependent Claims 2-11 is also patentable.

For the foregoing reasons, Applicant submits that Claims 1-11 are allowable.

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## CONCLUSIONS

In view of the remarks presented above, Applicant submits that the present application is in condition for allowance. As such, the issuance of a Notice of Allowance is therefore respectfully requested. In order to expedite the examination of the present application, the Examiner is encouraged to contact Applicant's undersigned attorney in order to resolve any remaining issues.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,

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